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(54) **SYSTEM AND METHOD FOR FORMATTING AND DISPLAYING VIDEO DATA**

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H04N 7/01	(2006.01)
H04N 21/4402	(2011.01)
H04N 21/2343	(2011.01)

(52) **U.S. Cl.**
CPC ***H04N 7/0122*** (2013.01); ***H04N 21/234363*** (2013.01); ***H04N 21/440272*** (2013.01)

(58) **Field of Classification Search**
CPC H04N 7/0122; H04N 21/440272; H04N 7/0117; H04N 21/234363; H04N 21/44029
USPC 348/445, 556, 558; 380/270–272
See application file for complete search history.

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WO	2006112808	A1	10/2006

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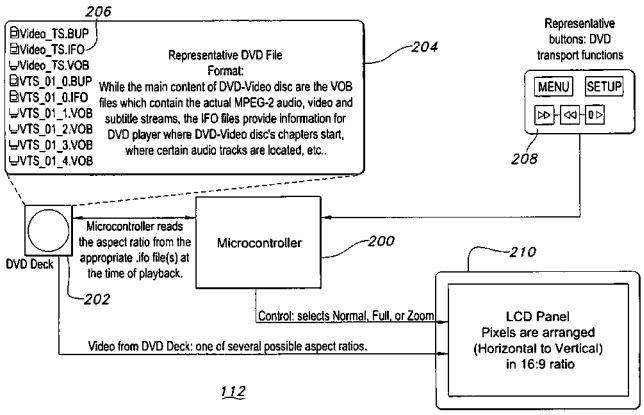
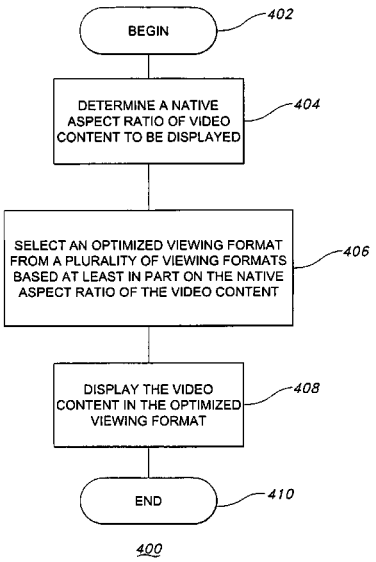
(57) **ABSTRACT**

There is provided a system (**200**) and method (**400**) of displaying video content. In a method (**400**) in accordance with an exemplary embodiment of the present invention, a native aspect ratio of the video content is determined (**404**) and an optimized viewing format is selected (**406**) from a plurality of viewing formats based at least in part on the native aspect ratio of the video content. The video content is displayed (**408**) in the optimized viewing format.

5 Claims, 4 Drawing Sheets





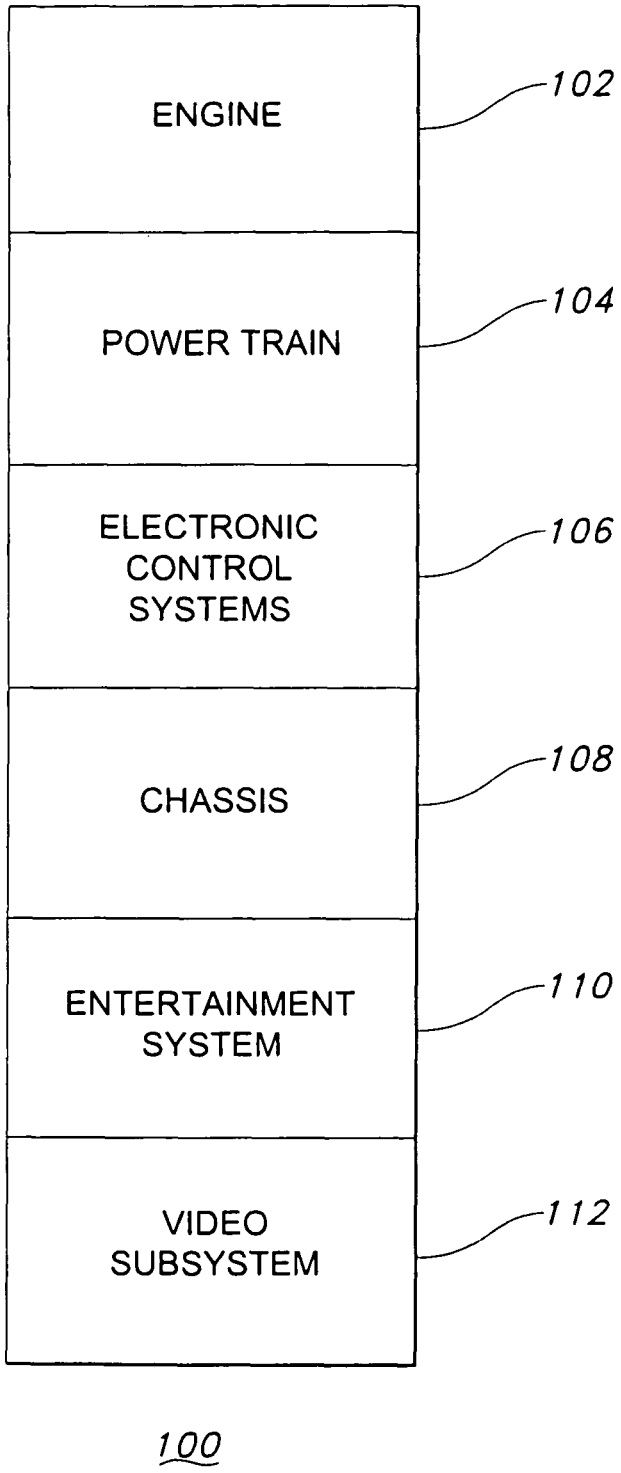

ENGINE
102
POWER TRAIN
104
ELECTRONIC CONTROL SYSTEMS
106
CHASSIS
108
ENTERTAINMENT SYSTEM
110
VIDEO SUBSYSTEM
112
100

FIG. 1

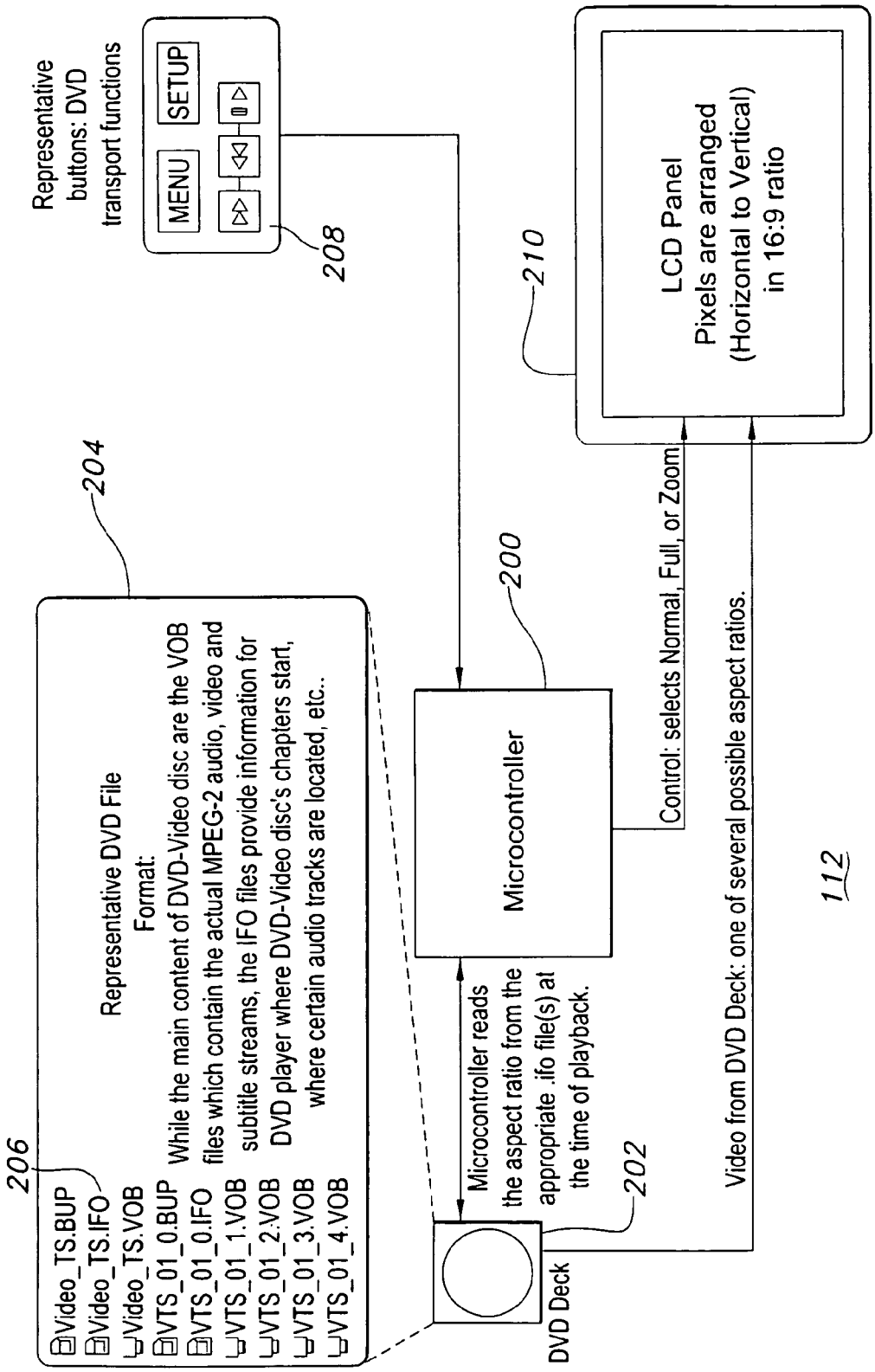

Representative buttons: DVD transport functions
MENU
SETUP
208
210
LCD Panel
Pixels are arranged
(Horizontal to Vertical)
in 16:9 ratio
204
200
Representative DVD File
Format:
While the main content of DVD-Video disc are the VOB files which contain the actual MPEG-2 audio, video and subtitle streams, the IFO files provide information for DVD player where DVD-Video disc's chapters start, where certain audio tracks are located, etc..
Microcontroller
Control: selects Normal, Full, or Zoom
206
Video_TS.BUP
Video_TS.IFO
Video_TS.VOB
VTS_01_0.BUP
VTS_01_0.IFO
VTS_01_1.VOB
VTS_01_2.VOB
VTS_01_3.VOB
VTS_01_4.VOB
Microcontroller reads the aspect ratio from the appropriate .ifo file(s) at the time of playback.
202
Video from DVD Deck: one of several possible aspect ratios.
DVD Deck
112

FIG. 2

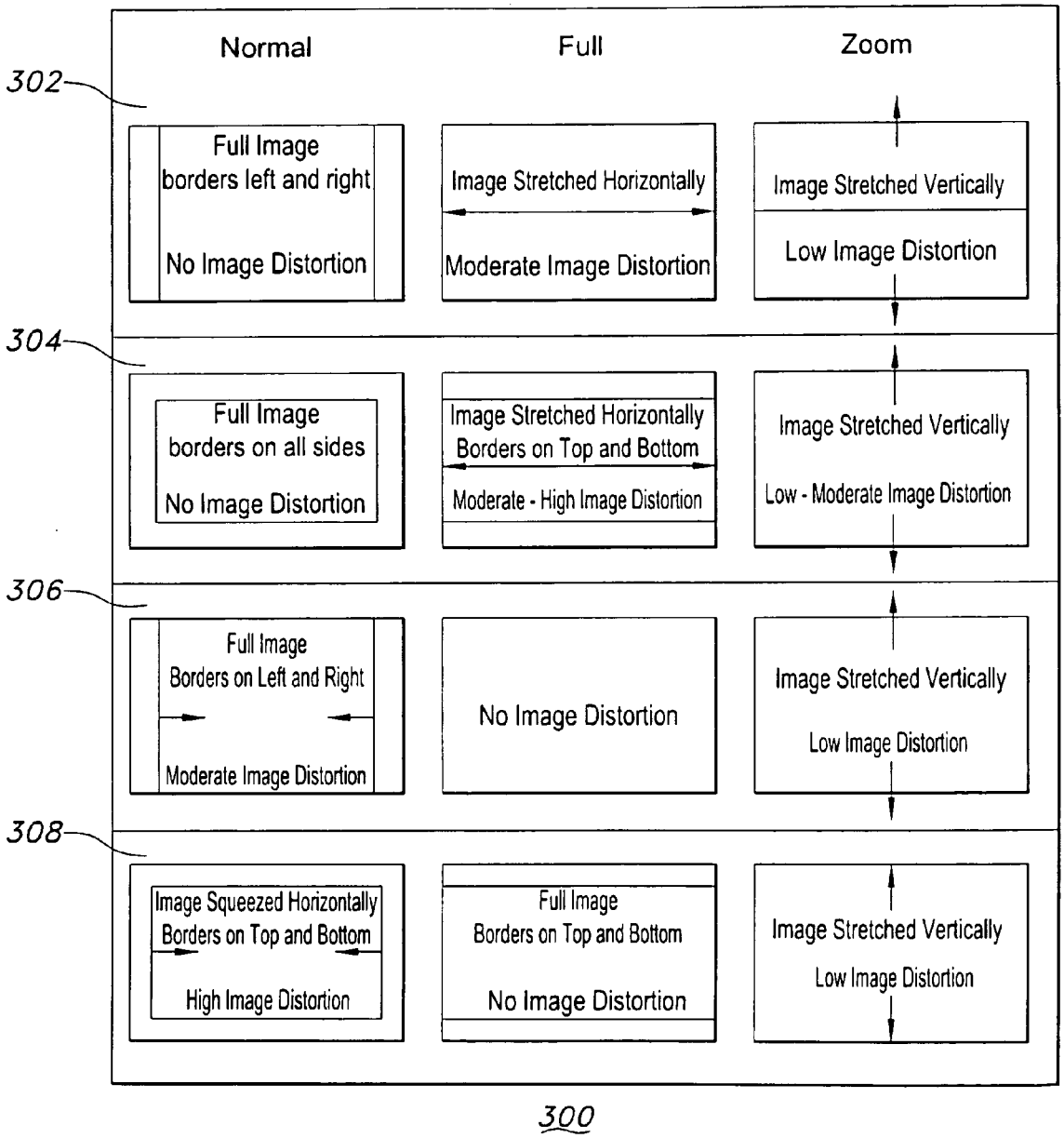

Normal
Full
Zoom
302
Full Image borders left and right
No Image Distortion
Image Stretched Horizontally
Moderate Image Distortion
Image Stretched Vertically
Low Image Distortion
304
Full Image borders on all sides
No Image Distortion
Image Stretched Horizontally Borders on Top and Bottom
Moderate - High Image Distortion
Image Stretched Vertically
Low - Moderate Image Distortion
306
Full Image Borders on Left and Right
Moderate Image Distortion
No Image Distortion
Image Stretched Vertically
Low Image Distortion
308
Image Squeezed Horizontally Borders on Top and Bottom
High Image Distortion
Full Image Borders on Top and Bottom
No Image Distortion
Image Stretched Vertically
Low Image Distortion
300

FIG. 3

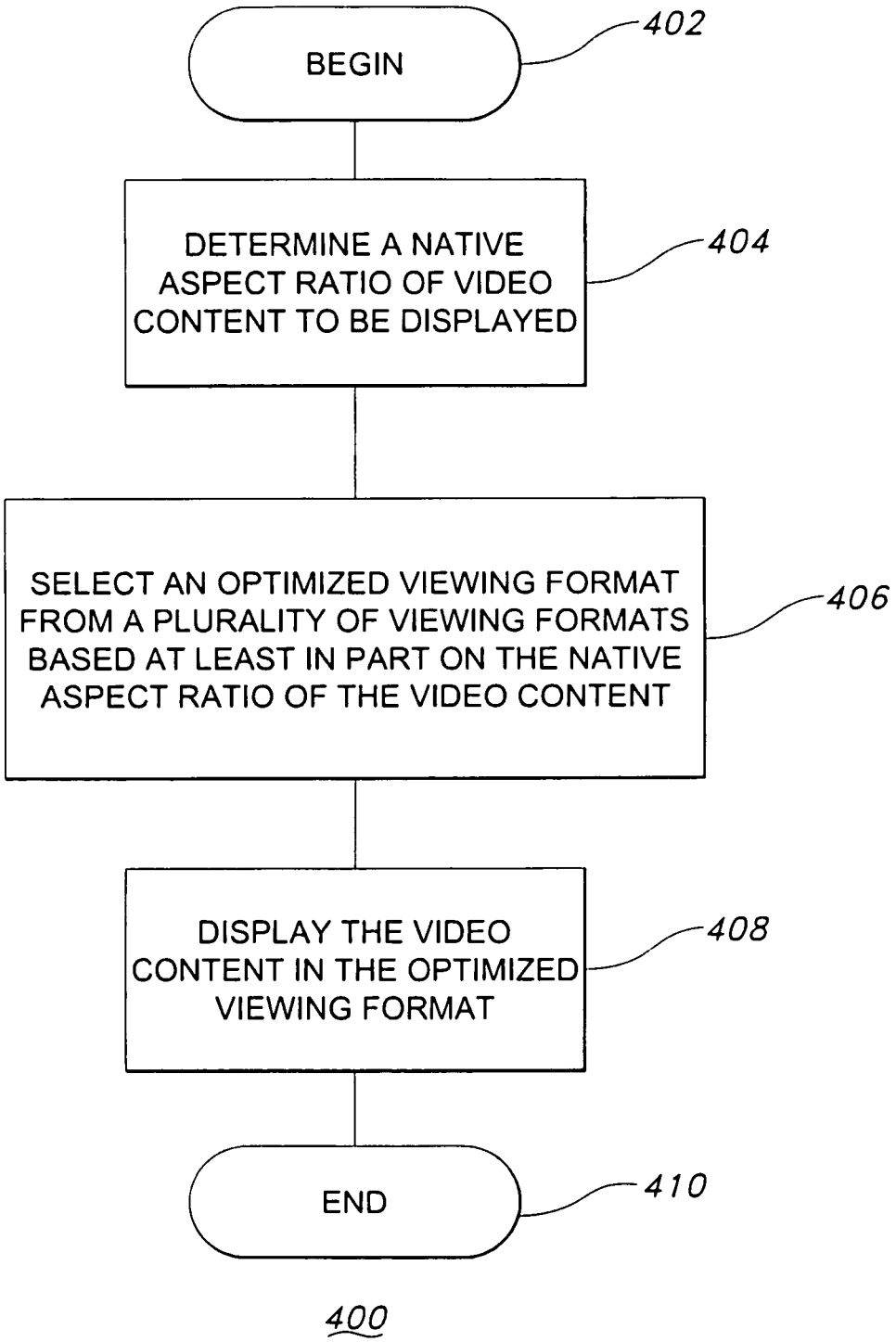

BEGIN
402
DETERMINE A NATIVE ASPECT RATIO OF VIDEO CONTENT TO BE DISPLAYED
404
SELECT AN OPTIMIZED VIEWING FORMAT FROM A PLURALITY OF VIEWING FORMATS BASED AT LEAST IN PART ON THE NATIVE ASPECT RATIO OF THE VIDEO CONTENT
406
DISPLAY THE VIDEO CONTENT IN THE OPTIMIZED VIEWING FORMAT
408
END
410
400

FIG. 4

SYSTEM AND METHOD FOR FORMATTING AND DISPLAYING VIDEO DATA

FIELD OF THE INVENTION

The present invention generally relates to video systems. In particular, the present invention relates to a system and method for formatting the display of video data based at least in part on a native aspect ratio of the video data.

BACKGROUND OF THE INVENTION

This section is intended to introduce the reader to various aspects of art which may be related to various aspects of the present invention which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present invention. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

In existing video systems, video content may be provided in a wide variety of aspect ratios (the ratio of the length of viewable display area to the height of viewable display area). Moreover, there is no standard aspect ratio for video content. Popular aspect ratios include 1.33:1 (4:3), 1.66:1 (15:9), 1.78:1 (16:9), 1.85:1 and 2.35:1, to name just a few examples.

Most display systems have a display device with a fixed aspect ratio. This means that a displayed image may appear distorted to a viewer if the native aspect ratio of the video content is different from the aspect ratio of the display device. Another potential problem is the display of "black bars" (areas where no video content is present) at the top and bottom or sides (or both) of a displayed image having a different aspect ratio. This results in a smaller video display, which can cause viewer dissatisfaction. Some known systems have "zoom" features, which perform an adjustment on displayed video to better accommodate the showing of video content from a source having a different aspect ratio. However, the large number of aspect ratios currently available could render the use of such "zoom" features cumbersome and ineffective for at least some aspect ratios. Moreover, the user may be forced so choose from among several display options by trial and error to find the desired setting. An improved system and method for formatting video data having a different native aspect ratio relative to a display device is desirable.

SUMMARY OF THE INVENTION

There is provided a system and method of displaying video content. In a method in accordance with an exemplary embodiment of the present invention, a native aspect ratio of the video content is determined and an optimized viewing format is selected from a plurality of viewing formats based at least in part on the native aspect ratio of the video content. The video content is displayed in the optimized viewing format.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of the present invention, and the manner of attaining them, will become apparent and be better understood by reference

to the following description of one embodiment of the invention in conjunction with the accompanying drawings, wherein:

FIG. **1** is a block diagram of a motorized vehicle in accordance with an exemplary embodiment of the present invention;

FIG. **2** is a diagram of a video subsystem of the vehicle shown in FIG. **1** in accordance with an exemplary embodiment of the present invention;

FIG. **3** is a diagram showing several examples of how an optimized viewing format is selected in accordance with an exemplary embodiment of the present invention; and

FIG. **4** is a process flow diagram of a method in accordance with an exemplary embodiment of the present invention.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate a preferred embodiment of the invention, in one form, and such exemplifications are not to be construed as limiting in any manner the scope of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

One or more specific embodiments of the present invention will be described below. In an effort to provide a concise description of these embodiments, not all features of an actual implementation are described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

FIG. **1** is a block diagram of a motorized vehicle in accordance with an exemplary embodiment of the present invention. The motorized vehicle is generally represented by the reference number **100**. The exemplary motorized vehicle **100** comprises an engine **102**, a power train **104**, a plurality of electronic control systems **106** that may be adapted to control a number of vehicle systems (for example, the engine, the power train, a heating ventilation air conditioning (HVAC) system, to name a few examples), and a chassis **108**. The chassis **108** is adapted to support the engine **102**, which is adapted to drive the power train **104**. Also included in the exemplary motorized vehicle **100** is an entertainment system, which may provide audio/visual entertainment, computer networking capability or the like to occupants of the motorized vehicle **100**. The entertainment system **110** comprises a video subsystem **112**, the operation of which is explained in greater detail below. In particular, the video subsystem **112** is adapted to select an optimized viewing mode for video data read from a source input regardless of the native aspect ratio of the video data.

FIG. **2** is a block diagram of the video subsystem **112** of the vehicle **100** shown in FIG. **1** in accordance with an exemplary embodiment of the present invention. The video subsystem **112** comprises a processor or microcontroller **200**, which is adapted to control the overall operation of the video subsystem **112**. The processor **200** may be adapted to read instructions and/or data from a tangible machine-

readable media, such as a disc drive, a memory or the like. The instructions may enable the processor **200** to perform a method in accordance with an exemplary embodiment of the present invention.

The processor **200** is operatively connected to a DVD deck **202**, which may contain a DVD media **204** as a source of video information. In addition to storing one or more files of video data, the DVD media **204** may additionally store an information file **206**, such as an .ifo file or the like. The information file **206** may contain information pertaining to where chapters of different video information start on the DVD media **204**, where certain audio tracks are located or the like. In addition, the information file **206** may store other information such as a native aspect ratio of video information stored on the DVD media **204**, whether the video data is in anamorphic format, whether the video data is in non-anamorphic format or the like.

The video subsystem **112** includes a user control panel **208**. As shown in FIG. **2**, the user control panel **208** may comprise controls such as MENU, SET-UP, FAST FORWARD, REWIND, PAUSE, PLAY, or the like. Users of the video system **112** may use the controls on the control panel **208** to control the operation of the video subsystem **112**.

In an exemplary embodiment of the present invention, the processor **200** is adapted to select an optimized viewing format for video information so that it is displayed effectively on a display panel **210**. In the exemplary embodiment illustrated in FIG. **2**, the display panel **210** has a fixed aspect ratio of 16:9. The processor **200** uses the aspect ratio information obtained about the video data being played to optimize the image displayed on the display panel **210**. In particular, an exemplary embodiment of the present invention selects an optimized viewing format based on design considerations such as using the maximum screen area of the display panel **210** for displaying the image while minimizing distortion of the image, regardless of the native aspect ratio of the video information being displayed. Specific examples of how the optimized viewing format is selected in accordance with an exemplary embodiment of the present invention are illustrated in FIG. **3**.

FIG. **3** is a diagram showing several examples of how an optimized viewing format is selected in accordance with an exemplary embodiment of the present invention. The diagram is generally referred to by the reference number **300**. The diagram **300** illustrates four different video formatting scenarios, each representing the displaying of video data having a particular aspect ratio, range of aspect ratios and other defining characteristics. Three screen views are shown for each of the four video formatting scenarios: a normal viewing mode, a full viewing mode and a zoom viewing mode. Thus, each of the four horizontal groupings of screen views corresponds to one of the four different video display scenarios illustrated in FIG. **3**.

As explained in detail below, a video system that operates in accordance with an exemplary embodiment of the present invention is adapted to determine a native aspect ratio of video content that is being displayed and to select an optimized viewing mode (for example, the normal viewing mode, the full viewing mode or the zoom viewing mode) based at least in part on the native aspect ratio of the video content. In an exemplary embodiment of the present invention, the normal viewing mode displays data in its native aspect ratio regardless of the aspect ratio of the display screen. In an exemplary full viewing mode, video data is "stretched" along one axis (for example, horizontal or vertical) so that the entire display screen is filled. In an exemplary zoom viewing mode, video data may be stretched along both axes (for example, horizontal and vertical) to essentially magnify an area of content while filling the entire display screen. In the exemplary zoom viewing mode, video data is less distorted in some cases than in the full viewing mode, but all of the original video data may not be displayed because of cropping excess video data to allow the picture to be expanded along the opposite axis. For example, video data may be cropped from the top and bottom as the image is expanded along the horizontal axis to fill the entire display panel.

The viewing format chosen as the optimized viewing format may vary depending on the aspect ratio of the display panel of a particular video system. For example, the optimized viewing format may not be the same in a video system having a display panel with an aspect ratio of 4:3 as it would be in a video system having a display panel with an aspect ratio of 16:9. All the screen views shown in FIG. **3** represent how video data would be displayed on a display screen having an aspect ratio of 16:9. This corresponds to the aspect ratio of the display screen **210** (FIG. **2**). Those of ordinary skill in the art will appreciate that the determination of which viewing mode is chosen as the optimized viewing mode may be made based on which available viewing mode would result in filling the most of the display panel with video data while providing the least amount of distortion.

In an exemplary embodiment of the present invention, the processor **200** (FIG. **2**) may be adapted to automatically read the aspect ratio of video data being displayed. For example, the aspect ratio may be read from the information file **206** (FIG. **2**). In other exemplary embodiments, the native aspect ratio of the video data being displayed may be determined by any suitable method known to those of ordinary skill in the art.

A first video formatting scenario **302** relates to the formatting of image data having a native aspect ratio of 4:3. This type of video content includes video data that may have been created in another aspect ratio and subsequently processed using a technique know to those of ordinary skill in the art as "pan and scan" formatting. In pan and scan formatting, a 4:3 window of video content is selected from video data in a different (normally wider) format to produce video content having an aspect ratio of 4:3. The normal view for the first video scenario **302** shows a screen view of the image area that would be displayed on a display having an aspect ratio of 16:9 if the video information is displayed in its native 4:3 aspect ratio format. As shown in FIG. **3**, this normal view would result in black borders having no video image content on both the right and left sides of the screen.

In the full view for the first video formatting scenario **302**, the image is stretched horizontally so that it occupies the entire 16:9 display. This horizontal stretching results in moderate image distortion because no corresponding vertical stretching is performed on the image.

In the zoom view of the first video formatting scenario, the full image is stretched vertically so that some video information is cropped from the display, as shown by the arrows in the zoom view for the first video formatting scenario **302**. By performing the additional vertical stretching, image distortion is reduced with respect to the full view.

An exemplary embodiment of the present invention is adapted to select the zoom viewing mode as the optimized viewing mode if the video content being displayed has a native aspect ratio of 4:3 if the display panel of the video system is 16:9. By automatically displaying video content having a native aspect ratio of 4:3 in the zoom mode as the optimized viewing mode, the user is provided with a picture that fills the entire display screen and has relatively low

distortion with respect to the full viewing mode. Thus, an exemplary embodiment of the present invention provides an optimized display without requiring the user to manually select the viewing mode from a plurality of choices. In an alternative embodiment of the invention, the user may be given the opportunity to provide an input regarding a preference of viewing modes. For example, the user could be allowed to select a particular viewing mode to be used for displaying all video, regardless of native aspect ratio. As another example, the user could be allowed to enter a preference selected from a group of choices such as "least distortion" or "maximum screen utilization."

A second video formatting scenario **304** relates to the formatting of video having a native aspect ratio in the range of 1.66:1 to 2.35:1 that is additionally in non-anamorphic format. Such video formatting may be described as wide-screen non-anamorphic video formatting. In colloquial terms, this type of formatting is sometimes referred to as "letter boxed" formatting.

In the normal view of the second display formatting scenario **304**, the entire image is displayed, but there are borders on all sides of the screen that contain no video data. In the full viewing mode of the second video formatting scenario **304**, the image is horizontally stretched so that it occupies the entire horizontal range of the display. Nonetheless, borders having no video data are still present on the top and bottom of the screen, resulting in moderate to high image distortion. In the zoom view of the second video formatting scenario **304**, the video data that would be presented in the full view is stretched vertically, as shown by the arrows in the zoom view. The zoom view in the second video formatting scenario **304** thus presents the viewer with a full video display with low to moderate image distortion.

An exemplary embodiment of the present invention is adapted to select the zoom viewing mode as the optimized viewing mode if the video content being displayed is non-anamorphic and has a native aspect ratio in the range of 1.66:1 to 2.35:1 if the display panel of the video system is 16:9. By automatically displaying video content with these characteristics in the zoom mode as the optimized viewing mode, the user is provided with a picture that fills the entire display screen and has relatively low distortion with respect to the full viewing mode.

A third video formatting scenario **306** relates to the formatting of media content having an aspect ratio in the range of 1.66:1 to 1.85:1 that is in anamorphic format. Such video content is typically referred to as wide-screen anamorphic video content. In the normal view of the third video formatting scenario **306**, the wide-screen anamorphic video data appears to be horizontally squeezed, as shown by the inward arrows. The result is moderate image distortion and bands containing no video information along the left and right sides of the display.

In the full view of the third video formatting scenario **306**, the anamorphic wide-screen video data is horizontally stretched with respect to the normal view so that it occupies the entire display. The result is a distortion-free image that fills the entire display screen. In the zoom view of the third video formatting scenario **306**, the full image is stretched vertically so that some video information is cropped from the display as shown by the arrows. In an exemplary embodiment of the present invention, the processor **200** (FIG. **2**) may be adopted to automatically display the full view as the optimized viewing mode for wide screen anamorphic video content having a native aspect ratio in the range of 1.66:1 to 1.85:1. In this manner, the viewer is automatically presented with a completely filled video screen having no image distortion.

A fourth video formatting scenario **308** relates to the formatting of anamorphic video content having an aspect ratio of 2.35:1. In the normal view of the fourth video formatting scenario **308**, the image appears to be squeezed horizontally, as shown by the inward arrows. The result is a highly distorted video image having borders on both sides as well as on the top and bottom. In the full view of the fourth video formatting scenario **308**, the native image is stretched horizontally so that it is displayed without image distortion. This nonetheless leaves borders with no video content along the top and bottom edges of the screen. In the zoom view of the fourth video formatting scenario **308**, the full image is stretched vertically until it fills the entire screen. This results in a low-level of image distortion.

For anamorphic video data having a native aspect ratio of 2.35:1, an exemplary embodiment of the present invention may be adapted to automatically select either the full viewing mode or the zoom viewing mode as the optimized viewing mode based on system design considerations. Choosing the full viewing mode as the optimized viewing mode results in an image that has no distortion but that does not fill the entire display screen. Choosing the zoom mode as the optimized viewing mode produces an image that fills the entire video panel but has some amount of distortion. Those of ordinary skill in the art will appreciate that the aspect ratio of the display panel of the video system in which the invention is applied may influence the choice of optimized viewing mode under these conditions.

FIG. **4** is a process flow diagram of a method in accordance with an exemplary embodiment of the present invention. The method is generally referred to by the reference number **400**.

At block **402**, the process begins. At block **404**, the native aspect ratio of video content to be displayed is determined. As set forth above, the aspect ratio may be read from an information file **206** (FIG. **2**) such as an .ifo file or determined by any other suitable method.

At block **406**, an optimized viewing format is selected from among a plurality of viewing formats based at least in part on the native aspect ratio of the video content. In the exemplary embodiment of the present invention discussed above with reference to FIG. **3**, the optimized viewing mode is determined to be a normal viewing mode, a full viewing mode or a zoom viewing mode. In addition to the native aspect ratio of the video content to be displayed, other factors may be considered. Examples of other factors that may influence the choice of the optimized viewing mode include whether the video data to be displayed is anamorphic or non-anamorphic.

At block **408**, the video data is displayed in the optimized viewing format. At block **410**, the process ends.

While the invention may be susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as defined by the following appended claims.

What is claimed is:

1. A method (**400**) of displaying video content, the method comprising:

determining (**404**) a native aspect ratio of the video content;

selecting (**406**) an optimized viewing format from a plurality of viewing formats based at least in part on the native aspect ratio of the video content, wherein the plurality of viewing formats comprises a full viewing format in which the video content is stretched along one axis until it fills an entire display panel; and

displaying (**408**) the video content in the optimized viewing format.

2. A method (**400**) of displaying video content, the method comprising:

determining (**404**) a native aspect ratio of the video content;

selecting (**406**) an optimized viewing format from a plurality of viewing formats based at least in part on the native aspect ratio of the video content, wherein the plurality of viewing formats comprises a zoom viewing format in which the video content is stretched along two axes to magnify an area of the video content; and

displaying (**408**) the video content in the optimized viewing format.

3. A method (**400**) of displaying video content, the method comprising:

determining (**404**) a native aspect ratio of the video content;

selecting (**406**) an optimized viewing format from a plurality of viewing formats based at least in part on the native aspect ratio of the video content, wherein a zoom viewing mode in which the video content is stretched along two axes to magnify an area of the video content is automatically selected as the optimized viewing mode if the native aspect ratio of the video content is 4:3; and

displaying (**408**) the video content in the optimized viewing format.

4. A method (**400**) of displaying video content, the method comprising:

determining (**404**) a native aspect ratio of the video content, wherein determining the native aspect ratio of the video content comprises reading the native aspect ratio from an information file associated with the video content;

selecting (**406**) an optimized viewing format from a plurality of viewing formats based at least in part on the native aspect ratio of the video content; and

displaying (**408**) the video content in the optimized viewing format.

5. A video system (**200**), comprising:

a source (**202**) of video data;

a processor (**200**) that is adapted to read the video data from the source of video data, to determine a native aspect ratio of the video data, and to select an optimized viewing format from a plurality of viewing formats based at least in part on the native aspect ratio of the video content, wherein the plurality of viewing formats comprises:

a normal viewing format in which the video content is displayed in its native aspect ratio;

a full viewing format in which the video content is stretched along one axis until it fills an entire display panel; and

a zoom viewing format in which the video content is stretched along two axes to magnify an area of the video content; and

a display panel (**210**) that is adapted to display video data provided by the processor (**200**) in the optimized viewing format.

* * * * *